

WHAT IS CLAIMED IS:

1. A method for making libraries of hybrid polynucleotide molecules in which double-stranded polynucleotide molecules are not used as starting materials.

2. The method of claim 1, wherein two types of single-stranded polynucleotide molecules are used as starting materials and wherein the first-type molecule comprises stretches of sequences containing one or more parts of homology and one or more parts of heterology to the complementary sequence of the second-type molecule.

3. The method of claim 2, wherein the single-stranded polynucleotide molecules are fragmented and used as templates for *de novo* polynucleotide synthesis to create hybrid polynucleotide molecules.

4. The method of claim 2, wherein mutations are introduced into hybrid polynucleotide molecules prior, during or after the production of the hybrid polynucleotide molecules.

5. A method for making libraries of hybrid polynucleotide molecules, which comprises:

(i) preparing two single-stranded polynucleotide molecules comprising sequences which are complementary to each other,

(ii) randomly or non-randomly fragmenting the two single-stranded polynucleotide molecules,

(iii) incubating the fragmented molecules under conditions such that hybridization of fragmented polynucleotide molecules occurs and *de novo* polynucleotide synthesis on the hybridized molecules occurs,

(iv) denaturing the resultant elongated double-stranded polynucleotide molecules into single-stranded polynucleotide molecules,

(v) incubating the resultant single-stranded polynucleotide molecules under conditions such that hybridization of single-stranded polynucleotide molecules occurs and *de novo* polynucleotide synthesis on the hybridized molecules occurs, and

(vi) repeating at least two further cycles of steps (iv) and (v).